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April 2002 Volume III, Issue 4

New badge detects chemical components

HANSCOM AFB, Mass. — The Air Force Research Laboratory's Space Vehicles Directorate has developed a hazardous chemical detection badge that is expressly tailored for the warfighter.....2

ML's 2nd Lt. selected for Air Force soccer camp

WRIGHT-PATTERSON AFB, Ohio — When the Air Force women's soccer team takes the field for the Armed Forces Championship on May 8th, 2nd Lt. Laura Stearns hopes to be among the competitors. 3

ML Directorate develops waste stream treatment

W*RIGHT-PATTERSON AIR FORCE BASE, Ohio* — Researchers at the Air Force Research Laboratory's Materials and Manufacturing Directorate are developing cost-effective technologies to treat waste streams that contain emulsified petroleum-based substances such as fuels, oils and greases.....4

Groundbreaking ceremony for new AFRL toxicology lab

WRIGHT-PATTERSON AFB, Ohio. — The Air Force Research Laboratory Human Effectiveness Directorate broke ground March 18 for a $14.9 million project to construct a new building to house a tri-service toxicology research consortium.....5

Additional information is available online including:

- **Breaking News Features**
- **Corporate Calendar**
- **Contact Information**

Active aeroelastic wing highlights centennial of flight

by Alan Brown, NASA Dryden Flight Research Center

EDWARDS AFB, Calif. — As the first aircraft sporting the U.S. Centennial of Flight Commission's official logo, a modified NASA F/A-18 is poised to begin investigation of Active Aeroelastic Wing (AAW) technology—a 21st century, high-tech twist on wing warping for flight control pioneered by the Wright brothers almost a century ago. The aircraft was displayed April 3 during rollout ceremonies at NASA's Dryden Flight Research Center at Edwards Air Force Base, Calif.

The overall goal of this $41 million program is to demonstrate improved aircraft roll control through aerodynamically-induced wing twist on a full-scale manned supersonic aircraft.

AAW research could also enable thinner, higher aspect-ratio wings on future aircraft, which could result in reduced aerodynamic drag, allowing greater range or payload and improved fuel efficiency. Data obtained from flight tests at NASA Dryden will provide benchmark design criteria as guidance for future aircraft designs.

Centennial flight continued on page 3

READY TO ROLL — Pictured in front of a F/A-18 during rollout ceremonies at NASA's Dryden Flight Research Center at Edwards Air Force Base, Calif., from left, Dr. Don Paul, Air Vehicle Directorate Chief Scientist, Ed Pendleton, Air Vehicles Directorate, Active Aeroelastic Wing (AAW) Program Manager, AFRL Commander Maj. Gen. Paul D. Nielsen. The aircraft is set to begin investigation of AAW technology. (Air Force photo by Ranney Adams).

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http://extra.afrl.af.mil/news/index.htm

New badge detects chemical components

by Lt. Col. Guy C. Thompson, Space Vehicles Directorate

HANSCOM AFB, Mass. — The Air Force Research Laboratory's Space Vehicles Directorate has developed a hazardous chemical detection badge that is expressly tailored for the warfighter.

People can wear the badge to detect exposure to hazardous chemicals and document total dosage.

"The badge can detect six different types of contaminants from nerve gases to toxic industrial chemicals," said Dr. Edmond Murad, technical adviser for the Space Weather Center of Excellence and project lead.

"There are several scenarios for using the badges," said Catina Sparaco, the Electronic Systems Center product manager for the badge. "In one scenario, the badge can be worn individually to provide the warfighter with an audible warning of exposure to hazardous chemicals."

The idea for the badge came to Charles Pike in 1995, when he was the chief of the spacecraft interactions branch for the advanced weapons directorate. He held a brainstorming session to discuss ways to detect the chemical components of rocket fuels and their signatures resulting from space-environment interaction.

"We had a very intense space flight program then, having conducted experiments on 25 space shuttle missions," said Pike, now the branch chief of the space vehicles' technology outreach branch.

Pike recognized that the same detection methods used to detect rocket fuel, which is a toxic chemical, in space missions could be applied on a somewhat smaller level, such as a badge.

"Each badge has an array of sensors, which are about the size of a postage stamp," he said. "A badge can be modified depending on the components you want to detect, so sensors can be changed out for different missions."

The project received the attention and endorsement of the Department of Defense after the Japan sarin gas incident, Murad said. The badges are currently being field tested by civil engineers. **@**

Find additional Fe@tures on the web

Ricky Arcuri selected as Champion Child

Information Institute holds anniversary workshop

AFRL chemist featured on stage in Maria Callas play

ML's 2nd Lt. selected for Air Force soccer camp

by Katherine Gleason, AFRL Public Affairs

WRIGHT-PATTERSON AFB, Ohio — When the Air Force women's soccer team takes the field for the Armed Forces Championship on May 8th, 2nd Lt. Laura Stearns hopes to be among the competitors.

Stearns was one of 20 Air Force women selected to participate in the 2002 All Air Force Women's Soccer Trial Camp. The camp is being held April 20 – May 7, at Pope Air Force Base, N.C. Players selected to the Air Force team will train and compete throughout the month of May.

Stearns currently works as an acquisition manager for the Air Force Research Laboratory's Materials and Manufacturing Directorate. She also serves as an alternate unit environmental coordinator and will soon begin managing contracts.

She began playing soccer at 13 and continued through college. She competed four years at the NCAA Division I level at Robert Morris University, Moon Township, Pa. Her primary position is sweeper, but she also plays midfielder.

"I'm very excited about this opportunity," Stearns said. "This was something that I set out to do, and it's great that my goal is coming true. I'm really looking forward to meeting new people and seeing some different bases."

In order to prepare for the camp, Stearns plans to focus on running and ball skills. All invitees were encouraged to report to camp in good physical condition.

Also selected from Wright-Patterson Air Force Base was 2nd Lt. Polly Sandness, who works for ASC.

The team will begin competition with the Armed Forces Championships, May 8-16, in Ft. Eustis, Va. From May 17-23, the team will stay at Ft. Eustis and train for the Conseil International du Sport Militaire Championships, to be held May 24-June 2, in Kingston, Ontario, Canada.

2nd Lt. Laura Stearns

The Armed Forces Sports Council added women's soccer to its programs in 1998. Since that time, the Air Force team has enjoyed a great deal of success—winning the Armed Forces Championship in 1999 and 2001.

Wright-Patterson Air Force Base is the first assignment for Stearns, who completed Officer Training School in Nov. 2001. **@**

Centennial Flight(from page 1)

The AAW program is a cooperative venture of the U.S. Air Force Research Laboratory, Boeing's Phantom Works, and NASA Dryden, to research the use of lighter-weight flexible wings for improved maneuverability of future high-performance aircraft. The project reflects both a return to aviation's beginnings, and a gateway to the future—a future where aircraft will sense their environment, and adapt their shape to the existing flight conditions.

"This aircraft and this technology is the first research stepping stone to dramatically improved performance and safety that NASA intends to pursue for the 21st century aircraft," said Denis Bessette, project manager for AAW flight research at NASA Dryden.

"Active Aeroelastic Wing both returns aeronautics to its beginnings, and opens the way to new avenues of lifting surface research in the future," added Ed Pendleton, Active Aeroelastic Wing program manager for the AFRL, Wright-Patterson Air Force Base, Ohio.

The test aircraft—an F/A-18A obtained from the U.S. Navy—has been modified with additional actuators, a split leading edge flap and thinner wing skins that will allow the outer wing panels to twist up to five degrees. The traditional wing control surfaces—trailing edge ailerons and the outboard leading edge flaps—are used to provide the aerodynamic force needed to twist or "warp" the wing. Project engineers hope to obtain almost equivalent roll performance of production F/A-18s at transonic and supersonic speeds without deflecting the horizontal tail and with smaller control surface movements.

The most extensive loads testing ever performed in Dryden's Flight Dynamics Laboratory was conducted last year on the F/A-18's modified wings. The six-month structural loads effort included wing twist or torsional testing and extensive loads calibration testing at up to 70 percent of the design limit load of the airplane, with load distribution over the wings a particularly critical item.

Following ground vibration tests and various checkout procedures, the two-phase AAW flight test program is slated to begin with parameter identification flights in July 2002. Boeing's Phantom Works will use data obtained from the first series of flights to refine wing effectiveness models and design the AAW flight control laws. The second phase of research flights to demonstrate the AAW concept with effective control laws should take place in mid- 2003, almost 100 years after the Wright brothers' first powered flight on Dec. 17, 1903.

Boeing Phantom works in St. Louis, Mo., modified the F/A-18's wings and is developing the active aeroelastic wing flight control software.

"We understood the challenge, drew on talent from across Boeing and the AAW program partners, and then applied that technical expertise to achieve results," said Jim Guffey, AAW program manager for Boeing Phantom Works. "We consider the AAW project a renaissance in flight control systems, and we're looking forward to flight testing."

The official Centennial of Flight logo was on the AAW aircraft Wednesday during the rollout ceremonies at NASA Dryden. "This logo honors the Wrights' accomplishments and the contributions of others whose vision, persistence and ingenuity have taken us from the sand dunes of North Carolina's outer banks to the surface of the moon and a permanent presence in space," said Debbie Gallaway, assistant director for programs at the U.S. Centennial of Flight Commission. "The history of aviation and aerospace is a story about individuals from around the world whose ability to dream of flight was only surpassed by their ability to make it happen. Their efforts revolutionized our world."

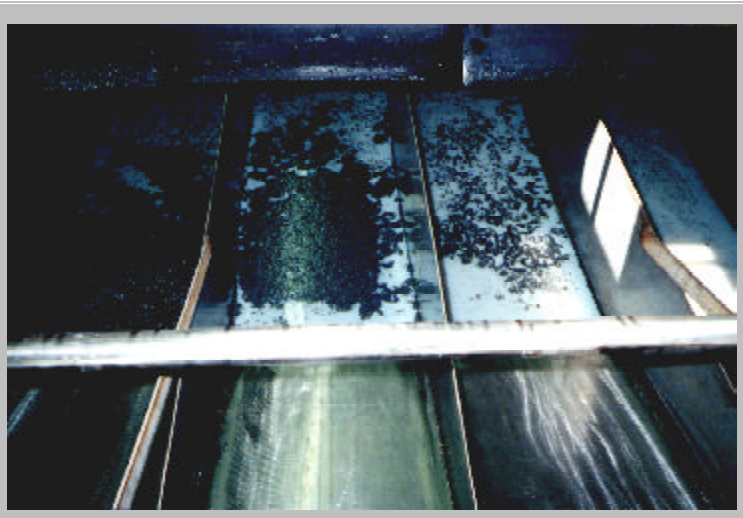
The U.S. Congress created the Centennial of Flight Commission in 1999 to serve as a national and international source of information about activities to commemorate the centennial of the Wright brothers' first powered flight on the sands of Kitty Hawk, North Carolina, on Dec. 17, 1903. Centennial activities are scheduled for 2003 in both North Carolina and Dayton, Ohio, home of the Wrights.

One of several Wright Flyer replicas is slated to fly at Dryden in 2003. In addition to these celebrations, numerous historical and educational projects are anticipated on the subject of aviation and aeronautics that will be an important legacy of the centennial of powered flight. **@**

ML Directorate develops waste stream treatment

by Capt. David Kempisty, John Spivey, and Tim Anderl, Materials and Manufacturing Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Researchers at the Air Force Research Laboratory's Materials and Manufacturing Directorate are developing cost-effective technologies to treat waste streams that contain emulsified petroleum-based substances such as fuels, oils and greases. The time-saving technologies can also be used to treat fire fighting chemicals, such as Aqueous Film Forming Foam (AFFF) that is used to suppress combustible and flammable liquid fuel fires.



Removal of oil and grease from emulsified waste stream in ASH clarifiers

Many Department of Defense (DoD) activities create waste streams from operations such as motor pool and aircraft wash racks, fuel tank cleaning operations, storm drains, and fire fighter training. To ensure optimal waste stream management, researchers have evaluated several different treatments, including biological treatment, reverse osmosis, and other physical and chemical removal methods. The most effective treatment system they have found is Air-Sparged Hydrocyclone (ASH) Technology, which was developed through collaborative research between AFRL, the Naval Facilities Engineering Service Center and the contractor, Kemco Systems, Inc.

Air Force researchers expect this technology will be a valuable tool in treating a variety of DoD generated waste streams where prior alternative treatment methods were non-existent, ineffective or extremely costly. Until now, solutions to wastewater challenges included "pump and treat," where a contractor takes the waste stream away at a significant cost to the military. Another solution was sending a small amount (due to the high toxicity and foaming characteristics of AFFF) to the industrial wastewater treatment plant each day. However, installations using this method generate more than they can send out each day, making this a larger problem as time passes.

Anxious to test the ASH technology, researchers developed a field test/demonstration project to validate the effectiveness of the ASH system at removing emulsified fuels, oil and grease, and AFFF from waste streams generated at nine DoD sites. The objective of the project was to demonstrate the commercial viability of the system, to allow an audience to witness the operation of the technology, and to open doors for transfer of the technology to other DoD agencies and industry.

The ASH system works by combining flotation principles with the separation characteristics of a hydrocyclone, which separates fuel, oil and grease from water. In the case of fine particles and oil removal, the ASH system improves the ability of fine particles and oil droplets to float. First, a strong centrifugal force field is developed, which increases the inertia of fine hydrophobic particles and oil droplets. Second, a high-speed swirl flow exerts considerable shear force at a porous wall. When air is introduced through the extremely fine pores in this wall, numerous small air bubbles attach to the particles and oil droplets. When the bubble and particle or droplet are attached, they are transported a short distance and are removed from the water.

When used in the removal of AFFF or any other foam-generating compound, the ASH system uses the compound's own foam-forming capabilities to strip it from water. These compounds are comprised of surface-active substances that concentrate where air and water interface to generate stable foams. The ASH's uniquely controlled aeration and flow control process effectively separates the AFFF compound from water.

During the demonstration, success of the system was determined by comparing the post-treatment concentrations of fuel, oil, and grease, total suspended solids, and AFFF to influent concentrations and local discharge limits. In the absence of a regulatory limit of AFFF, a target value of under 50 parts per million (ppm) was used.

The ASH system consistently met its objectives of demonstrating and quantifying its ability to effectively and efficiently remove emulsified oil and grease, and AFFF from wastestreams. The system resulted in an average removal rate greater than 87 percent and greater than 90 percent for oil and grease removal and AFFF removal, respectively. These results were achieved in streams that contained varying types and concentrations of contaminants, in streams that contained oil and grease only, AFFF only, and in streams that contained a combination of all contaminants.

These results were also achieved in cases of high AFFF concentration (over 500 ppm). A recirculation option was incorporated into the system allowing batch operation. In this fashion, wastewater can be processed multiple times until the desired effluent concentration is obtained.

In most cases, the concentrated sludge remaining from ASH processing was less than 10 percent of the original stream volume, and in many cases, lower than seven percent. Toxicity leaching tests conducted on this sludge reported that the sludge is classified as non-hazardous.

The predicted operating costs for the system are dependent on the specific contamination characteristics of the waste stream. The costs of operation during the DoD demonstrations ranged from $.17 per 1,000 gallons treated for AFFF treatment with no chemical treatment, to $2.54 per 1,000 gallons treated for extremely high oil and grease concentrations with chemical pre-treatment. The operating costs include the cost of consumables and utilities associated with the system. **@**

Groundbreaking ceremony for new AFRL toxicology lab

by Tiffany Pitts, ASC Public Affairs

WRIGHT-PATTERSON AFB, Ohio. — The Air Force Research Laboratory Human Effectiveness Directorate broke ground March 18 for a $14.9 million project to construct a new building to house a tri-service toxicology research consortium. This construction project, known as the toxic hazards effects laboratory, will provide a location for the Air Force, Army and Navy to conduct toxicology research at Wright-Patterson Air Force Base.

"The construction of the toxic hazards effects laboratory facility is a tremendous opportunity to spur our biotechnology initiative," said James Brinkley, Director of the Human Effectiveness Directorate. "This initiative, which has been planned by our directorate in partnership with several other Air Force Research Laboratory directorates, will capitalize on the strong science foundation that has been established by the tri-service toxicology research corsontium."

Brinkley said the biotechnology initiative provides an excellent vehicle to accelerate existing partnerships with local universities and industry.

Graphic representation of the toxic hazards effects laboratory, scheduled for completion in 2003. (Air Force image)

This project will provide approximately 44,995 square feet of laboratory space for research activities. Several examples of these activities include: pathology, histology, image analysis, kinetics, dermal studies/analytical chemistry, genomics/proteomics, immunohisto-chemistry, combustion toxicology, invitro and molecular, and inhalation and respiratory exposure.

Application of this research includes the development of revolutionary genetically-based analytical systems to provide predictive capabilities to protect our warfighters. These systems will employ knowledge derived from the Human Genome Project to better assist potential dangers in operational areas and to monitor adverse toxic reactions in our military personnel, officials said.

Messer Construction is the contractor for this project, which is scheduled for completion in Fall 2003. **@**

DE safety officer honored with two command awards

by Rich Garcia, Directed Energy Directorate

WRIGHT-PATTERSON AFB, Ohio – Two headquarters-level awards were presented in April to an Air Force Research Laboratory employee from Kirtland Air Force Base, N.M.

Michael D. Martin, a safety engineer with the laboratory's Directed Energy Directorate, was presented with the Air Force Materiel Command Patricia Terrell Memorial System Safety Award, and the Environmental Safety and Occupational Health Program Professional of the Year Award. The awards represent Martin's contributions to improving personnel and systems safety, and reducing the risk for personal injury.

Martin was cited, in part, for having completed several studies and surveys: one was a nine-month radon survey, and two were studies having to do with mold-contamination assessments in the workplace. He also conducted 17 ergonomic surveys that led to the installation of corrective equipment for employees, thus averting as estimated $935,000 in potential worker compensation costs over the lifetime of each employee.

"The current average compensation claim in the Air Force for an ergonomic injury is $55,000," noted Martin. He further saved the organization nearly $8,000 a year by finding and using salvaged parts or inexpensive new parts to fix ergonomic problems.

By handling health and safety issues for the directorate's 40-person detachment in Maui, Hawaii, the laboratory avoided contracting that support, thus saving more than $4,000 a year.

Additionally, Martin was cited for a safety plan that reviewed and recommended changes to a test program and the design of a chemical laser support system. In a separate matter, his recommendations helped resolve a safety issue that was in dispute between two other base organizations. He also helped train medical squadron workers to be able to spot experiment hazards.

Michael D. Martin

Martin conducted an annual ground safety inspection of 111 laboratory areas in 48 industrial buildings. His efforts contributed to completing the year without any reportable ground mishaps.

A letter from the AFRL Vice Commander, Col. Michael L. DeLorenzo praised Martin, noting, "The success of the safety program within the Directed Energy Directorate is a direct result of [Martin's] self-motivated efforts and proactive approach toward safety." **@**

Net Index

Due to the number of submissions we receive, some sections of *news@**afrl*** are available exclusively on-line. The on-line version of the newsletter allows users to view the AFRL corporate calendar, news releases generated by AFRL headquarters, operating instructions, L@b L@urels and Roundups sections.

The L@b L@urels section of the electronic newsletter is dedicated to members of Air Force Research Laboratory who receive awards and honors. The Roundups section of the electronic newsletter keeps Air Force Research laboratory employees informed about contracts AFRL has awarded. Below is an index of articles one can find in each of these on-line sections.

L@b L@urels

- **HE honors its best at awards luncheon**
- **ML project recogized as one of year's most technically innovative products**
- **Rome honors student with science fair award**
- **AFRL honors contracting excellence**
- **IF honors its military personnel**

Stay tuned for the May edition featuring...

Research Laboratory exhibit debuts at Space Sympoisum

and

Thank a Teacher

For more on these stories see news@afrl
http://extra.afrl.af.mil/news/index.htm

POW/MIA salute at AFRL Rome military ceremony

ROME, N.Y. - Members of the Air Force Research Laboratory Rome Research Site Honor Guard conduct a POW/MIA ceremony during the Rome Research Site Military Ball held March 8 at the Hotel Utica. Brig. Gen. Ted Bowlds, the last commander of the former Rome Laboratory, served as featured speaker for the event. (Air Force photo by Albert P. Santacroce)

To view the full text of these and other articles visit the *news@**afrl*** page on the Internet at http://extra.afrl.af.mil/news/index.htm.

To submit L@b L@urels or Roundups from your directorate, send a query to AFRL Public Affairs at:

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